PATENT SPECIFICATION

947,669

947,669

Inventor: SPENCER BOWMAN.

Date of Application and filing Complete Specification: November 8, 1961. *No.* 40063/61

Complete Specification Published: January 29, 1964.

Index at Acceptance:—**B8** A31A1.

International Classification:—F 06 g.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Sprocket Chain

We, THE THEW SHOVEL COMPANY, a Corporation organised and existing under the laws of the State of Ohio, United States of America, of 1374, East 28th Street, Lorain, Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a sprocket chain and particularly to a rollerless sprocket chain in which bushes are inserted between the side link plates to take the place of the bushes and rollers employed in roller chains.

As is well-known in the art, chains and sprockets are used on a great many different classes of machinery for transmitting power of comparatively great magnitude and at high speeds. The basic concept in the roller chain art has remained essentially unchanged during the past fifty years or longer and it has been known that a so-called bushing chain (a chain resembling the roller chain except that the bushings between the side links are not provided with rollers) may be employed in instances where considerable power is to be transmitted but where the speed is relatively low. However, such bushing chain has never been thought of as a satisfactory substitute for the roller chain in high speed and heavy duty applications.

Upon careful investigation of the wearing characteristics of roller chains, it has been discovered that the rollers thereof turn only slightly on their bushings and then less than 20% of the running time as the chain passes around the sprockets. In many purportedly worn-out chains which have rollers that are loose on their bushings, it has been found that the roller looseness is due solely to the expansion of the rollers as occasioned by the impact to which they are subjected as they pass around the sprockets. In that connection, the weights of the loose rollers is exactly the same as the weight of the rollers of a new unused chain. It has also been discovered that about 65% of the users' complaints of roller chains have to do with pin failures, this apparently being due to the great deflection of the pins under load to an extent of 8% or more of their lengths. The rest of such complaints have to do with outside link failures and to small extent (1%) with failures of other parts of roller chains.

With the foregoing in mind, the present invention provides a rollerless sprocket chain suitable for the transmission of high power at high speed, particularly a rollerless sprocket chain made up of alternating overlapping pairs of inner and outer link plates each having an aperture at each end, in which transverse pins spaced apart by a pitch length P have their ends non-rotatably secured in the apertures in the outer link plates, in which bushes of unbroken cross-section are rotatably mounted on the pins between the outer link plates and have their ends stepped and non-rotatably secured in the apertures in the inner link plates, in which the diameter of the pins is 0.36P, in which the thickness of the link plates is at least 0.15625P, in which the outside diameter of the bushes is 0.56P and in which the outside diameter of the stepped ends of the bushes is 0.48P, the dimensions being correct to ± 0.005 inch.

Preferably, the inner and outer link plates have necked center portions such that the area of the transverse section through the center of each link plate is substantially the same as the area of the transverse section through the centres of the apertures in each plate.

A preferred embodiment of the invention

[Price 4s. 6d.]

will now be described with reference to the accompanying drawing, in which:—

Fig. 1 is a side elevation view of a rollerless sprocket chain embodying the present invention; and

Fig. 2 is a cross-section view taken substantially along the line 2-2, Fig. 1.

Referring now more specifically to the drawing, the rollerless sprocket chain herein comprises parallel outside link plates 1 of generally figure-eight shape with rounded ends including pitch holes therethrough through which the hardened (carburized or through-hardened) pins 2 extend in force-fitted relation, all of the pins 2, except the connecting pin 3, being provided with heads at both ends. The connecting pin 3 has a head at one end and a peripheral groove at the other end for a snap ring 4 or like retaining means.

Between the outside link plates 1 are similar figure-eight inside link plates 5 with rounded ends formed with holes therethrough in which the reduced diameter ends of bushes 6 are force-fitted with the shoulders 7 thereof in firm engagement with the inside faces of said links 5 and with the end faces of the bushings 6 flush with the outside faces of said links 5 thereby constituting spacer means to maintain the outside links in parallel spaced apart relation.

To obtain the best results it has been discovered that for a chain of pitch P the following approximate relationships should be adhered to within a tolerance of ± 0.005 inch:

Diameter of pins 2 and 3	=0.36P
Bushing 6 outside diameter	=0.56P
Bushing 6 diameter at ends	0.48P
Outside and inside link thickness at least 0.15625 and preferably	0.16P
Outside and inside link width at pitch holes	=0.94P
Inside link width at neck	=0.46P
Outside link width at neck	=0.58P
Outside and inside link radius at rounded ends	=0.47P

A rollerless sprocket chain made in accordance with the above-listed proportions has a breaking load of nearly 70% greater than the corresponding A.S.A. (American Standard Association) roller chain. Insofar as fatigue strength is concerned, the preferred rollerless sprocket chain of the present invention has a maximum life which is about thirty times the maximum life obtained with the corresponding A.S.A. roller chain.

With reference to the neck 8 formed by concavely curved surfaces tangent to the rounded ends of each side link 1, this has been made somewhat more than one-half the maximum width of the link, namely, 0.58P for the neck width and 0.94P for the maximum width, whereas each side link 5 has a neck width formed by concavely curved surfaces tangent to the rounded ends of about 0.46P. It has been found that such proportioning of the neck widths with respect to each other, to the maximum link widths at the pitch holes, to the diameter of pin 2, and to the diameter of bushing 6 at its ends results in a balancing or even distribution of the strains on the links 1 and 5 under heavy loads, whereby failure occurs at a much heavier load when there is a separation at two zones of the inside links 5 denoted by the reference numerals 9 and 10.

Another characterizing feature of this invention is that despite the greatly improved results, the cost of the rollerless sprocket chain is approximately the same as the cost of the comparable A.S.A. roller chain and the omission of the rollers of the latter has not increased sprocket wear in any discernible way.

Following is a table of A.S.A. Standard Series roller chains:

Chain No.	Pitch (in.)	Pin Dia. (in.)	Link Thickness (in.)	Inside Link Width (in.)
35	3/8	0.141	0.050	0.344
40	1/2	0.156	0.060	0.452
50	5/8	0.200	0.080	0.594
60	3/4	0.234	0.094	0.679
80	1	0.312	0.125	0.903
100	1 1/4	0.375	0.156	1.128
120	1 1/2	0.437	0.187	1.354
140	1 3/4	0.500	0.219	1.647
160	2	0.562	0.250	1.900
200	2 1/2	0.781	0.312	2.275
240	3	0.937	0.375	——

By way of comparison, take for example, the A.S.A. 160 roller chain which has a pitch of 2". A chain for use with the same sprocket as is used with the A.S.A. 160 chain, will have a bushing 6 diameter of 1.125". However, the pin diameter will be 0.724" as compared with 0.562" and the side links 1 and 5 have a thickness of .3125" and

a width at the pick holes of 1.875", rather than 0.250" and 1.900" respectively. While the A.S.A. 160 roller chain has a published tensile strength of 58,000 lbs. it has been found that the actual tensile strength is somewhat less. In any event, using substantially the same steels and heat treatments as are used for the A.S.A. 160 roller chain, the present rollerless chain has a tensile strength of about 94,000 lbs. Likewise, with reference to dynamic loads, the rollerless chain made in accordance with the present invention has a dynamic strength or running capacity which is considerably greater than that of the A.S.A. 160 roller chain. Specifically, the rollerless chain herein of 2" pitch may be safely operated at well over 1,000 feet per minute, whereas, the A.S.A. 160 roller chain is recommended for a maximum speed of from 250 to 300 feet per minute. Most spectacular is the great increase in fatigue life because whereas an A.S.A. roller chain has an average fatigue life of 100,000 cycles, a comparable rollerless chain of the invention under the same loading conditions has a fatigue life of more than 3,000,000 cycles.

All in all, the present invention provides a rollerless sprocket chain which produces several unexpected results by following a predetermined pattern of enlargement of the A.S.A. Standard chain while eliminating the roller thereof and producing a chain which has vastly superior operating and fatigue-resisting characteristics at about the same cost as the A.S.A. Standard roller chain. Accordingly, where load and speed requirements would now dictate the use of a certain size of A.S.A. roller chain, it is possible to meet the load and speed requirements with a much smaller rollerless chain made in accordance with the present invention, or conversely, the rollerless chain of comparable size to the A.S.A. roller chain may be used for much greater loads and speeds. In either event, considerable economies are effected and there is no problem of enlargement of the bushing 6 by impact as there is with the thin roller of a roller chain.

WHAT WE CLAIM IS:—

1. A rollerless sprocket chain made up of alternating overlapping pairs of inner and outer link plates each having an aperture at each end, in which transverse pins spaced apart by a pitch length P have their ends non-rotatably secured in the apertures in the outer link plates, in which bushes of unbroken cross-section are rotatably mounted on the pins between the outer link plates and have their ends stepped and non-rotatably secured in the apertures in the inner link plates, in which the diameter of the pins is 0.36P, in which the thickness of the link plates is at least 0.15625P, in which the outside diameter of the stepped ends of the bushes is 0.48P, the dimensions being correct to ± 0.005 inch.

2. A chain as claimed in claim 1, wherein said outer link plates are of generally figure-eight shape with rounded ends of 0.47P radius struck from the centres of the apertures and with intermediate neck portions of 0.58P width formed by concavely curved surfaces that are tangential to the rounded ends, these dimensions being correct to ± 0.005 inch.

3. A chain as claimed in claim 1 or 2, wherein said inner link plates are of generally figure-eight shape with rounded ends of 0.47P radius struck from the centres of the apertures and with intermediate neck portions of 0.46P width formed by concavely curved surfaces that are tangential to the rounded ends, these dimensions being correct to ± 0.005 inch.

4. A chain as claimed in any preceding claim, wherein the inner and outer link plates have necked centre portions such that the area of the transverse section through the centre of each link plate is substantially the same as the area of the transverse section through the centres of the apertures in each plate.

5. A rollerless sprocket chain substantially as described herein with reference to the accompanying drawing.

For the Applicants:
D. YOUNG & CO.,
Chartered Patent Agents,
9 Staple Inn,
London, W.C.1

Berwick-upon-Tweed: Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.—1964
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained.

947,669 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

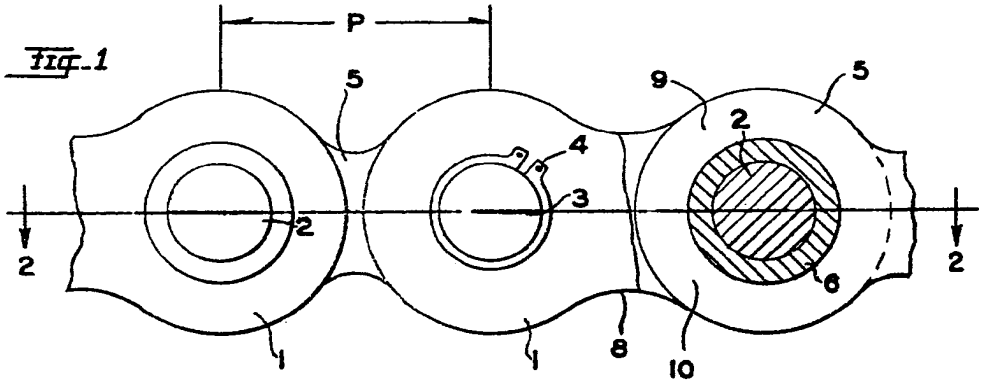

Fig. 2